Table S1. Data sources used in the study. For states with multiple fishery-independent surveys, standardized abundance indices were averaged with equal weighting.

Data	Source	Dataset name	URL
Blue crab abundance indices (fishery-independent surveys)	Massachusetts Division of Marine Fisheries	Massachusetts Young-of-Year Flounder Seine Survey	
	Univ. of Rhode Island Grad. School of Oceanography	Univ. of Rhode Island Fish Trawl Survey	
	New York State Dept. of Environmental Conservation	Peconic Bay Trawl Survey; Western Long Island Seine Survey – North; Western Long Island Seine Survey – South; Hudson River Young-of-Year Striped Bass Seine Survey	
	Delaware Division of Fish and Wildlife	Delaware Blue Crab and Juvenile Finfish Trawl Survey	
	Maryland Dept. of Natural Resources	Chesapeake Bay Blue Crab Summer Trawl Survey	
	Virginia Institute of Marine Science	VIMS Juvenile Fish and Blue Crab Trawl Survey	
	North Carolina Division of Marine Fisheries	Juvenile Anadromous Trawl Survey (P100); Pamilco Sound Survey (P195)	
	South Carolina Dept. of Natural Resources	South Carolina Blue Crab Pot Survey	
	Georgia Dept. of Natural Resources	Ecological Monitoring Trawl Survey	
Blue crab landings	NOAA Fisheries	Annual commercial landings	http://www.st.nmfs.noaa.gov/st1/commercial/landings/annual_landings.html
Bottom water temperature	NOAA NERRS Centralized Data Management Office	Water quality monitoring data Specific stations: Wells Bay, ME (Inlet) Great Bay, NH (Great Bay) Waquoit Bay, MA (Sage Lot) Narragansett Bay, RI (Nag Creek) Great Bay, NJ (Buoy 126) Delaware Bay, DE (Scotton Landing) Chesapeake Bay, MD (Jug Bay/Railroad) Chesapeake Bay, VA (Goodwin Islands)	http://www.nerrsdata.org

		Masonboro Island, NC (Research Creek) ACE Basin, SC (St. Pierre) Sapelo Island, GA (Lower Duplin)	
Sea surface temperature	NOAA National Climatic Data Center	Optimum Interpolation Sea Surface Temperature	https://www.ncdc.noaa.gov/oisst

Table S2. Summary of studies on blue crab thermal tolerance limits at different life stages.

Stage	Threshold	Temp. (°C)	Reference	Methods	Results
juvenile/ adult	LT_{min} LT_{max}	0-5 37-39	Tagatz 1969	Quantified 48 hour median thermal tolerance limit (TL_m or LD_{50}) for adult and juvenile crabs acclimated to different temperatures and salinities.	In full seawater, crabs acclimated to 6 and 14°C had lower TL_m values below the lowest temperature tested (0°C), and upper TL_m values around 33 and 35°C, respectively. Crabs acclimated to 22 and 30°C had lower TL_m values around 2.5 and 4.7°C, and upper TL_m values around 37 and 39°C, respectively. In 20% seawater, crabs were 0.2-2°C less cold and heat tolerant than in full seawater. Juveniles were less cold tolerant and more heat tolerant than adults, but differences were very slight (within 0.5°C).
			Holland et al. 1971	Quantified 1000 minute median upper thermal tolerance limit (TL_m) for juvenile crabs.	Upper TL_m for crabs acclimated to 20, 25, and 30°C were 37.1, 38.6, and 39.4°C, respectively. Temperatures above 39.5°C resulted in acute mortality.
			Rome et al. 2005	For Chesapeake Bay, examined relationship between February bottom water temperature and crab mortality (%) in winter dredge surveys.	Mortality of crabs increased from ≤ 3% to 6-14.5% when February bottom water temperatures dropped below 2°C.
				Exposed crabs to 3°C (typical winter conditions) for 60 days, 5°C (mild winter conditions) for 60 days, or to 1°C (cold snap) for 30 days followed by 3°C for 30 days, using different life stages and 3 salinities. Performed survival analyses.	Crabs exposed to the cold snap died more quickly than crabs held at 3°C for the entire period. Survival rates did not differ between the 3 and 5°C treatments. Mature females were less cold tolerant than small and medium juveniles. Survival rates were lower at lower salinities.
			Bauer & Miller 2010b	Exposed juvenile crabs to 3 or 5°C conditions under 2 salinity conditions for 121 days. Performed survival analyses.	Survival rates were lower at 3°C than at 5°C, and survival rates were lower at lower salinities.
	CT_{min} CT_{max}	9-15 33-34	Churchill 1919	Observations of crabs held in enclosures undergoing natural temperature fluctuations.	Adult crabs became sluggish and did not eat after water temperatures fell below "about 50°F" (10°C). "Very probably" crabs do not molt when water temperatures are less that 60°F (15.5°C).

			Holland et al. 1971	Reared juvenile crabs at a range of temperatures (27 to 35°C) for 45 days.	Crabs grew at all temperatures, but heat-induced mortality was observed above 30°C. Upper incipient lethal temperature was estimated as 33°C.
			Leffler 1972	Quantified growth of juvenile crabs held at under 5 temperature treatments (13, 15, 20, 27, 34°C).	Crabs grew when held at 15°C and higher, but crabs held at 13°C did not molt.
			Smith 1997	Compiled growth data from previously published studies (Tagatz 1968b, Fitz & Wiegert 1991). Extrapolated regression (inverse intermolt period as a function of temperature) to x-intercept to obtain T_{min} estimate (temperature at which growth ceases).	Extrapolation of regression gave a T_{min} estimate of 8.9°C.
			Brylawski & Miller 2006	Quantified growth of juvenile crabs held at under 5 temperature treatments (16, 20, 24, 28°C). Extrapolated regression (inverse intermolt period as a function of temperature) to x-intercept to obtain T_{min} estimate (temperature at which growth ceases).	Crabs grew at all experimental temperatures (growth rates decreased with temperature). Extrapolation of regression gave a T_{min} estimate of 10.8°C.
megalops	CT_{min} CT_{max}	15-20 30	Costlow & Brookhout 1959	Reared larvae under 3 temperature treatments (20, 25, 30°C) and 4 salinity treatments.	Only zoea raised at 25°C reached the megalops stage, and these megalopae completed development at this temperature. Survival was reduced at lower salinities.
			Costlow 1967	Using zoea grown at 25°C, reared megalopae under a range of temperature and salinity conditions.	Megalopae developed normally at 20, 25, and 30°C, but at 15°C they showed less than 50% survival and delayed development. Survival was reduced at lower salinities.
zoea	CT_{min} CT_{max}	20-25 29	Sandoz & Rogers 1944	Reared zoea under range of temperature and salinity treatments.	First stage zoea did not molt at temperatures below 20°C or above 29°C.
			Costlow & Brookhout 1959	Reared larvae under 3 temperature treatments (20, 25, 30°C) and 4 salinity treatments.	At all salinities, larvae did not molt and progress beyond the first zoeal stage at 20°C and 30°C. Larvae at 25°C completed development. Survival was reduced at lower salinities.

egg	CT_{min} CT_{max}	16-19 29	Sandoz & Rogers 1944	Reared eggs under range of temperature and salinity treatments.	Eggs hatched successfully between 19 and 29°C, with little variation in hatching percentage within this range. All eggs failed to hatch at 14, 17, 30, and 31°C.
			Amsler & George 1984	Reared early season eggs at 16°C at late season eggs at 26°C.	Egg hatching occurred at 16°C but with delayed development.

Table S3. CMIP5 climate models used to obtain daily multimodel mean sea surface temperatures.

Model Name	Modeling Center (or Group)
ACCESS1-3	Commonwealth Scientific and Industrial Research Organization (CSIRO) and Bureau of Meteorology (BOM), Australia
CMCC-CM	Centro Euro-Mediterraneo per I Cambiamenti Climatici
CMCC-CMS	Centro Euro-Mediterraneo per I Cambiamenti Climatici
CNRM-CM5	Centre National de Recherches Météorologiques / Centre Européen de Recherche et Formation Avancée en Calcul Scientifique
HadGEM2-CC	Met Office Hadley Centre
HadGEM2-ES	Met Office Hadley Centre (additional HadGEM2-ES realizations contributed by Instituto Nacional de Pesquisas Espaciais)
INM-CM4	Institute for Numerical Mathematics
IPSL-CM5A-LR	Institut Pierre-Simon Laplace
IPSL-CM5A-MR	Institut Pierre-Simon Laplace
IPSL-CM5B-LR	Institut Pierre-Simon Laplace
MIROC5	Atmosphere and Ocean Research Institute (The University of Tokyo), National Institute for Environmental Studies, and Japan Agency for Marine-Earth Science and Technology
MIROC-ESM-CHEM	Japan Agency for Marine-Earth Science and Technology, Atmosphere and Ocean Research Institute (The University of Tokyo), and National Institute for Environmental Studies
MIROC-ESM	Japan Agency for Marine-Earth Science and Technology, Atmosphere and Ocean Research Institute (The University of Tokyo), and National Institute for Environmental Studies
MPI-ESM-LR	Max-Planck-Institut für Meteorologie (Max Planck Institute for Meteorology)
MPI-ESM-MR	Max-Planck-Institut für Meteorologie (Max Planck Institute for Meteorology)
MRI-CGCM3	Meteorological Research Institute
MRI-ESM1	Meteorological Research Institute
NorESM1-M	Norwegian Climate Centre
NorESM1-ME	Norwegian Climate Centre

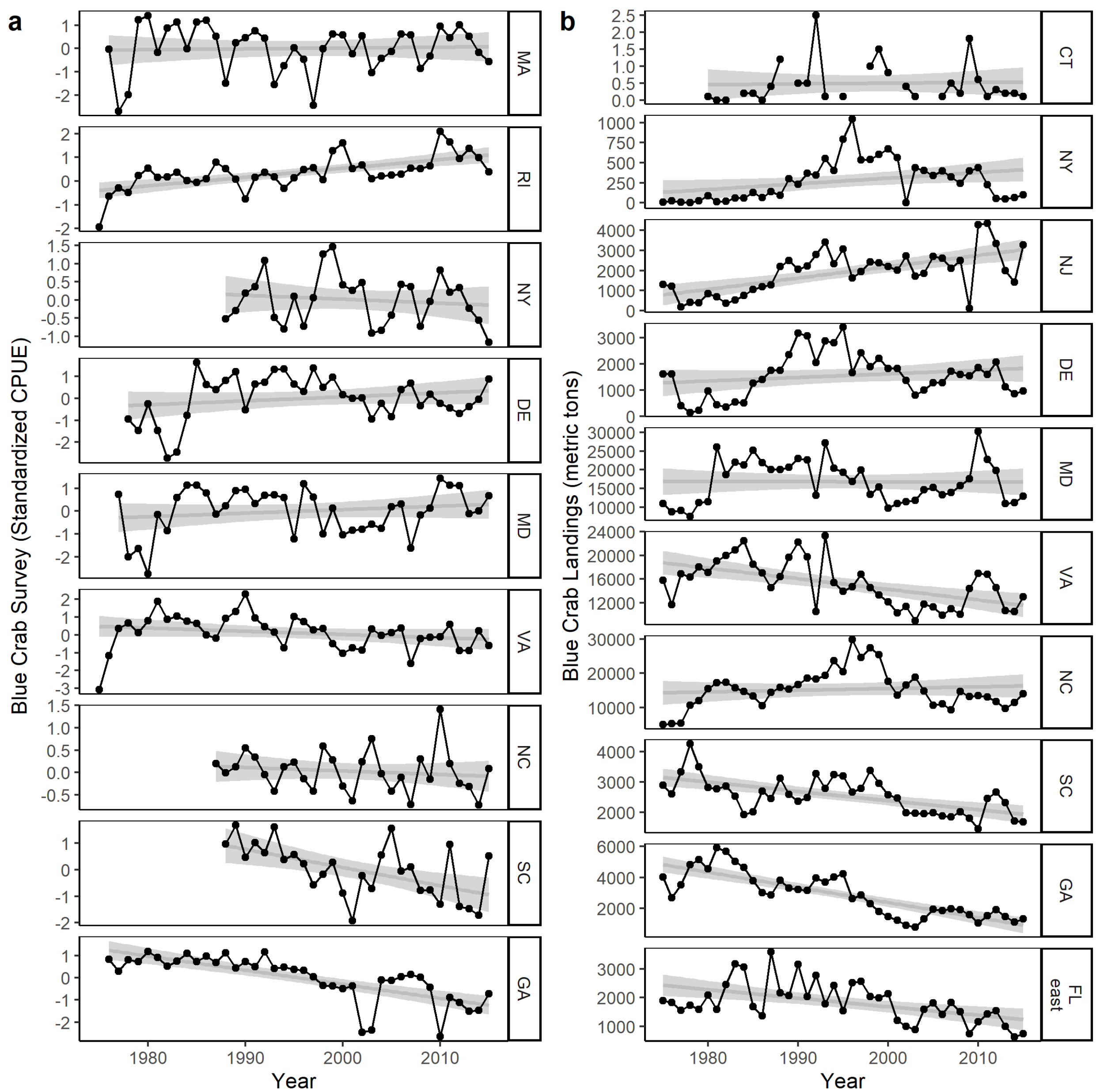

Fig. S1. Trends in blue crab abundance. (a) Blue crab annual abundance indices from fishery-independent surveys. (b) Annual commercial blue crab landings in U.S. Atlantic states. Linear regressions and 95% confidence intervals are show. Data sources listed in **Table S1**. State abbreviations as in **Fig. 1**.

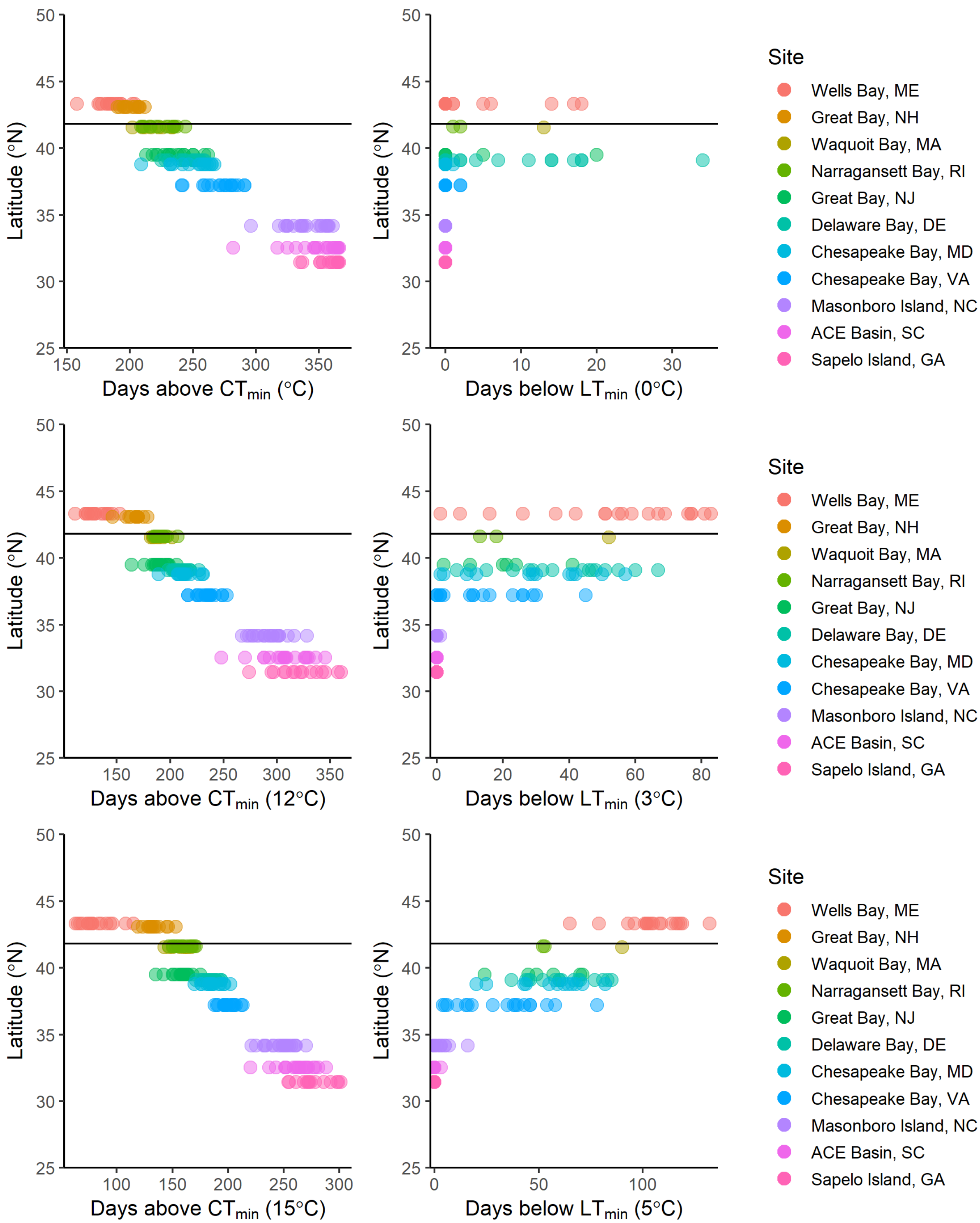

Fig. S2. Sensitivity analysis for temperature conditions in relation to blue crab adult/juvenile lower temperature tolerances. Minimum (top), mean (middle), and maximum (bottom) values of CT_{min} (left) and LT_{min} (right) are used. Horizontal black line is the historical blue crab northern range limit. State abbreviations as in **Fig. 1**.

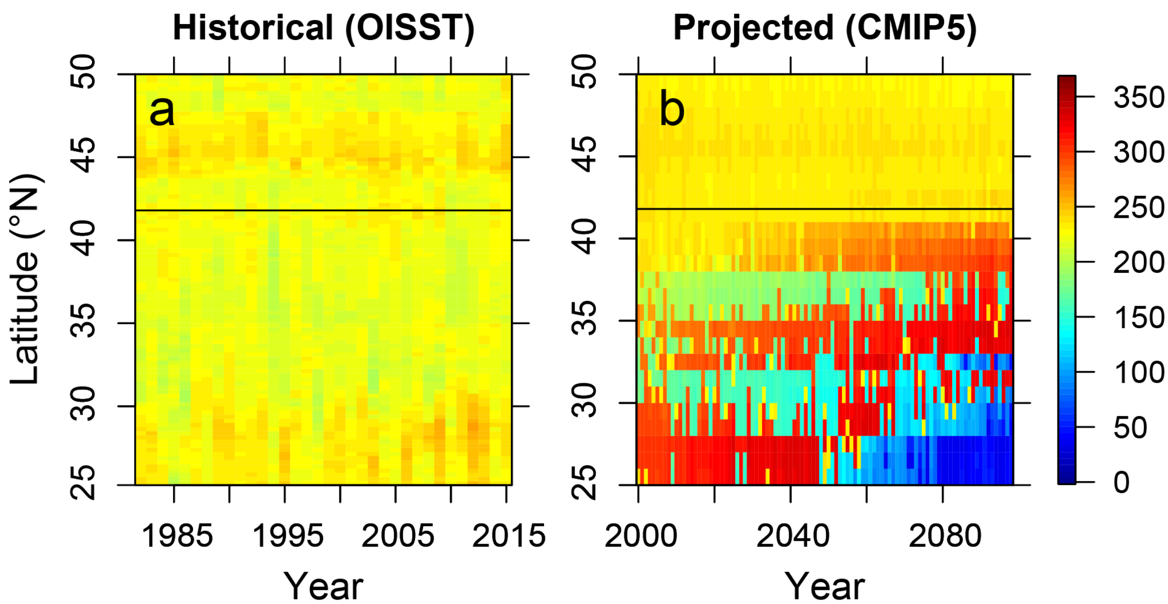

Fig. S3. Median day of the year (days after January 1) at which temperatures are above the 80th percentile, from (a) daily historical (OISST) and (b) projected (CMIP5) temperature datasets. Horizontal black line is the historical blue crab northern range limit.

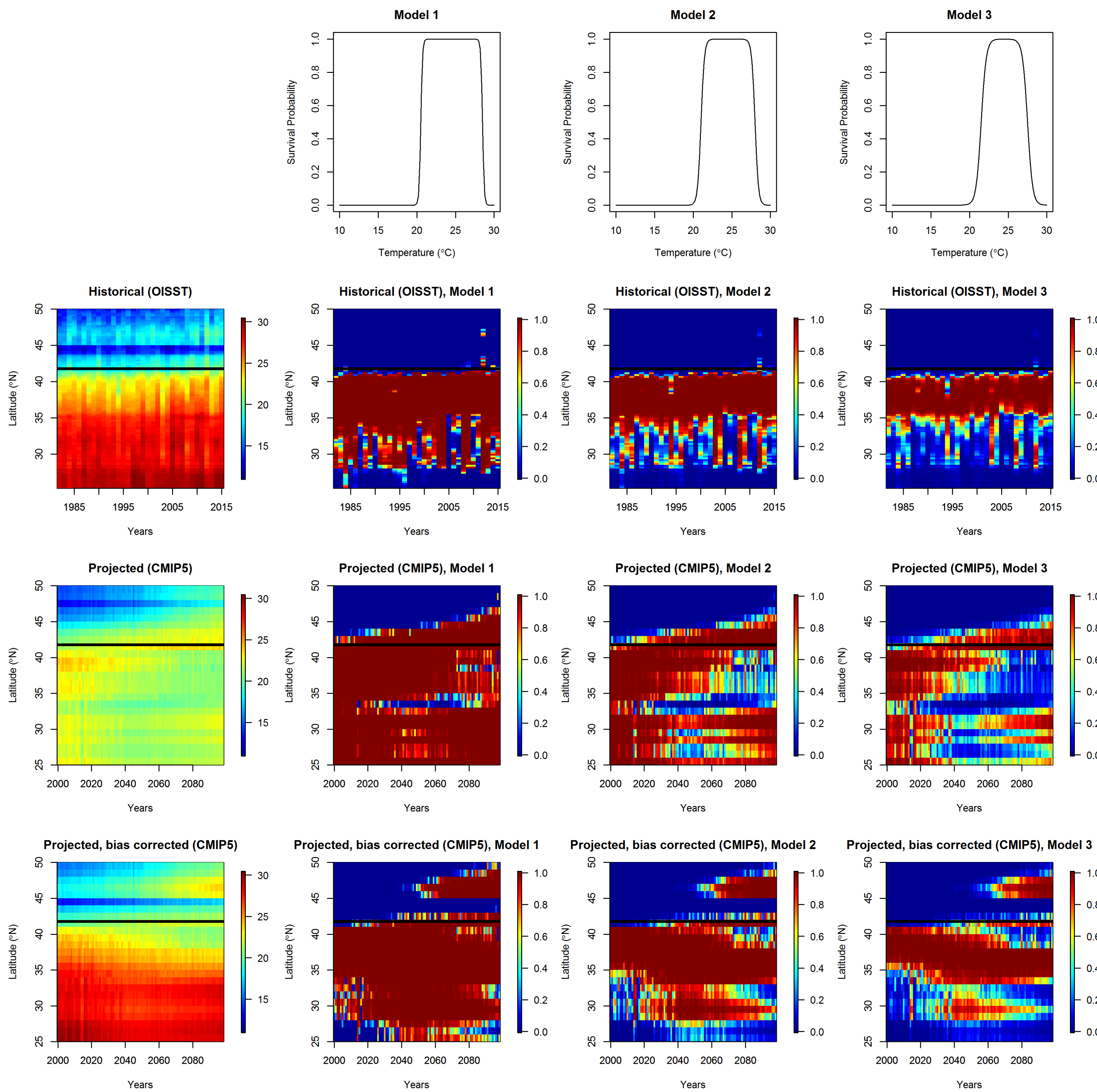

Fig. S4. Sensitivity analysis for temperature conditions in relation to blue crab larval (zoeal) temperature tolerances. Three models of larval survival probability (top panels, 50% survival probability at 0.5, 1.5, and 2.5°C above CT_{min} and below CT_{max}) are applied to historical, projected, and bias-corrected projected mean August temperature conditions (left panels). Horizontal black line is the historical blue crab northern range limit.

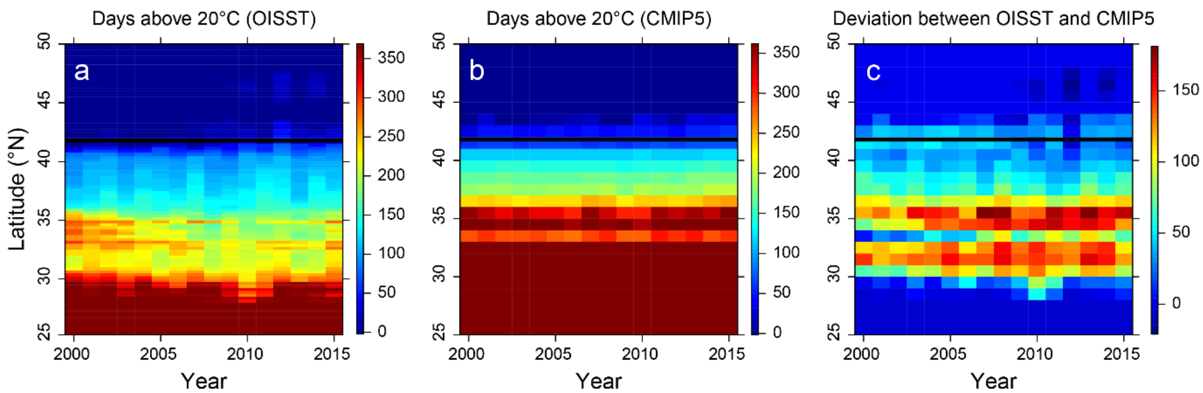

Fig. S5. Bias quantification for number of days above 20°C (larval CT_{min}). Calculated by subtracting results using historical (OISST) temperatures (a) from results using projected (CMIP5) temperatures (b) during the period of overlap (2000-2015) to obtain deviations (c). Horizontal black line is the historical blue crab northern range limit.

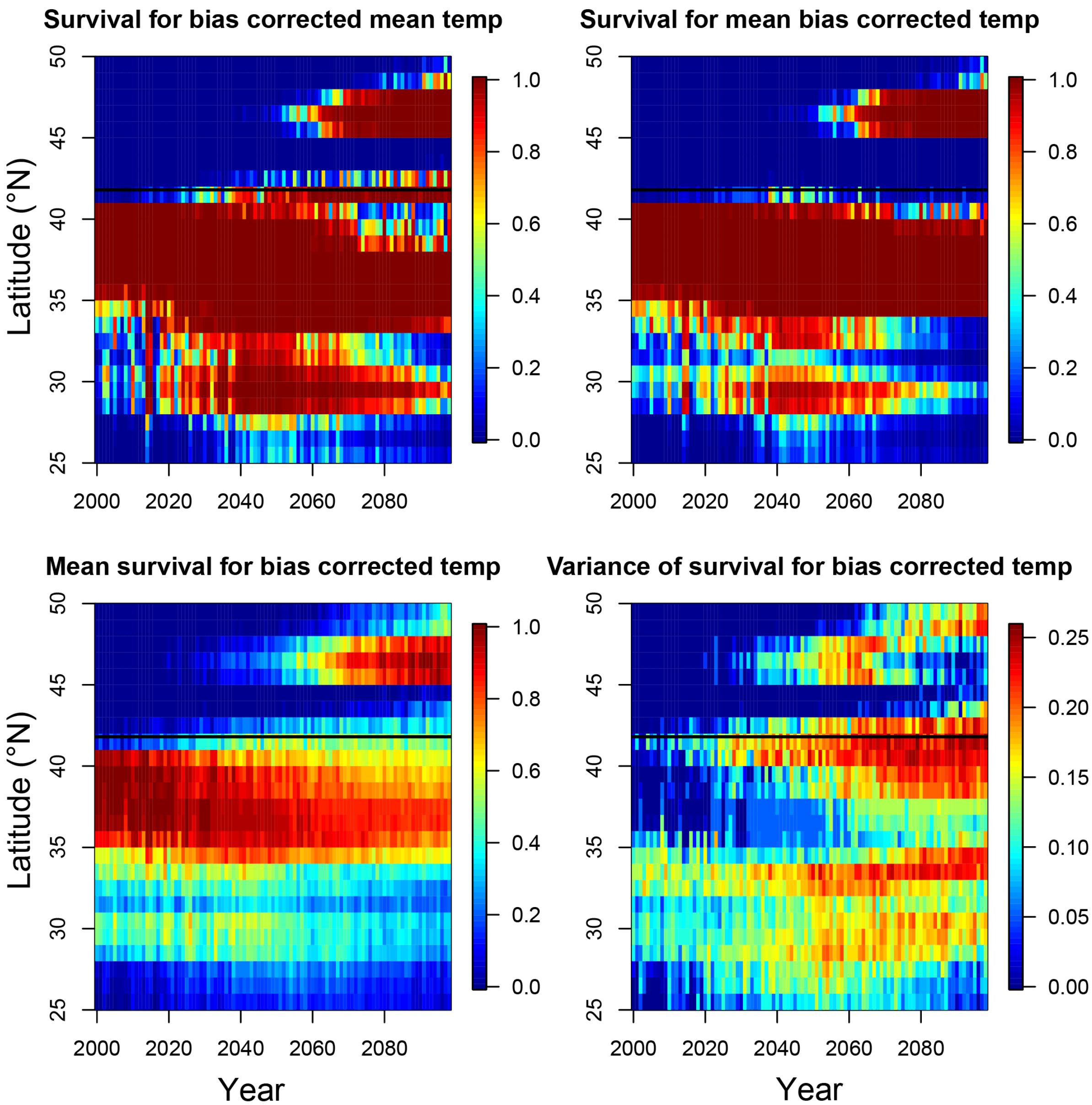

Fig. S6. Suitability for larval survival given mean August water temperatures. (a) Survival given bias corrected multimodel mean temperature. (b) Survival given multimodel mean bias corrected temperature. (c) Multimodel mean survival probability given bias corrected temperature. (d) Multimodel variance in survival probability given bias corrected temperature.

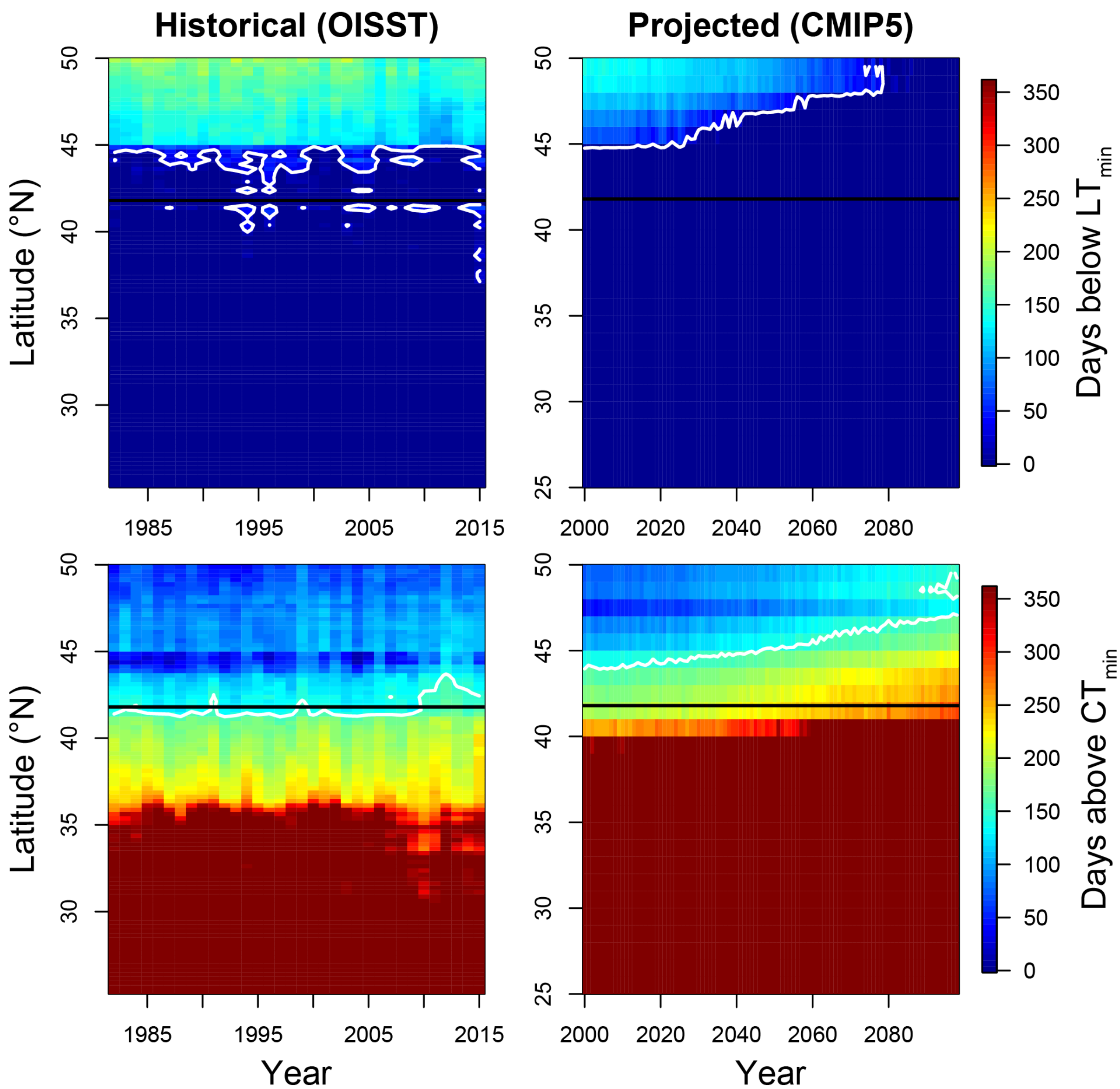

Fig. S7. Historical and projected temperature conditions in relation to blue crab juvenile/adult lower temperature tolerances. OISST = Optimum Interpolation Sea Surface Temperature, CMIP5 = IPCC Coupled Model Intercomparison Project. (a,b) Number of days below LT_{min} (3°C). Contour for 20 days is shown in white. (c,d) Number of days above CT_{min} (12°C). Contour for 150 days is shown in white.